MONOTYPE

HOW IT WORKS • EVOLUTION TO MEET NEW NEEDS • NON-DISTRIBUTION OF TYPE AND MATERIAL • THE INVENTOR

The

MONOTYPE

How it works • Evolution to meet new needs • Non-distribution of type and material • The inventor

1957

TOLBERT LANSTON was born in Troy, Ohio, on February 3, 1844. He received a public school education until the age of 15, after which he was self-supporting. He lived in Ohio and in Iowa until the Civil War, in which he took part as a volunteer. At the end of the War, at the age of 21, he moved to Washington, D. C. where he procured employment in the Pension Bureau. He became chief at various times of four of the divisions of the Bureau. He studied law, was admitted to the bar, and practiced his profession to some extent. However, his principal interest was invention and he invented, among other things a mail bag lock, an adjustable hydraulic dumbwaiter, an adding machine, and a curious adjustable horseshoe. From some of these earlier inventions he derived a moderate income and a degree of celebrity.

Probably, his attention was directed to typesetting problems through his acquaintance with Colonel Seaton, whose father had been of the firm of Seaton & Gales, owners of newspapers in Washington, D. C. and in Raleigh, North Carolina, and government printers for several years, when governmental and congressional printing was done by contractors. After the Civil War, Colonel Seaton became Director of the Census.

TOLBERT LANSTON was a visitor to the Census Bureau at a time when Herman Hollerith was developing his tabulating machine. Lanston is said to have given close attention to this machine, one of the first to classify and tabulate statistics by means of perforations in cards, transferable to a multiplying machine which was controlled by the perforations. It is said that Colonel Seaton was the first to assist Lanston financially, in putting his ideas relating to type composition into mechanical form, but his place as a financial supporter was at an early part in his history taken over by J. Maury Dove.

TOLBERT LANSTON applied for his patent in 1885; it being granted in 1887. The invention consisted of a keyboard and a typecasting and typesetting machine. The keyboard embodied the means of exact justification which continues to be one of the most important features of the Monotype. The earlier machines were controlled by two perforated records, one to position the matrix, the other to effect line-justification. The 1887 machine did not cast types. It pressed single types out of cold metal supplied to the machine in long type-high strips, shaved to the thickness of the required body. One of the perforated records set the metal strip in motion and controlled the extent of its travel to correspond with the width of the character to be made. The required width of metal was automatically cut from the metal strip, was passed into a compression box which corrected the irregularities in the body of the cutoff piece and held it while the desired character was stamped on its exposed upper end by means of a female die or matrix. There were 196 such matrices, each representing a separate character. The case holding the matrices was positioned by a second record strip. As the types were completed they were assembled in lines, and perfectly justified when the last character was added to each line. Except in the method of making the types, this first machine contained all the essential principles of later machines. However, it was immediately proved that types could not be made accurately or quickly enough by pressure in cold metal. This machine had the distinction of being one of the first with movements automatically controlled by electricity. The first experimental machine was made by D. Ballauf, machinist and model maker.

In the second machine the types were cast. The actuation was pneumatic instead of electric and the number of matrices was increased from 196 to 210. This machine proved to be impractical The controls by two perforated records and the matrix case were the same as in the first machine. Thus, the second machine in all its essential features prefigured the present machine, but was slow and not invariably reliable in some of its mechanisms. To increase production, "it was proposed to provide the machine with three similar molds, mounted at regular intervals around the outer circumference of a rotatable wheel or disk, the idea being to bring the molds successively to the casting point, and thence to a point where the cooled type was ejected." Whatever experiments may have been made, this idea was not carried out at the time, but a quadruple machine was made and exhibited at the World's Fair in Chicago in 1893. It is recorded that the machine functioned very well, but that its high cost and unavoidable complications were disadvantages not to be overcome. The experimental work on the pneumatic keyboard was done in the factory of the Taft-Peirce Manufacturing Company to which company Lanston came with his ideas, to interpret which, the preliminary drawings were made in that factory under Lanston's directions. Tolbert Lanston superintended the manufacture of the earlier machines which were made in Washington. In 1896 he was awarded the Cresson Gold Metal for original invention by the Franklin Institute of Philadelphia.

A long course of changes and experiments then ensued. in an effort to arrive at commercial practicability. This was accomplished in 1897 in which year an entirely new machine was designed by J. Sellers Bancroft, and built by William Sellers and Company Philadelphia, Pa. The machine was reduced in size. The capacity of the die case was limited to a partial font of 132

characters, a number thought to be sufficient for use on newspapers, the field in which the Monotype Company then expected to find its best market. It excelled previous models in speed, simplicity, and accuracy while adhering to the basic principles set forth by Lanston. The matrix case and matrices were entirely altered and standardized. The die case was an entirely new feature. The matrices were driven in copper and inserted in short oblong blocks of steel. A conical cavity in the foot of the matrix provided the means of clamping the selected matrix over the mold. The matrices were supported in the die case in a new manner. By means of a horizontal wire, all the matrices of a row were suspended in bearings in the die case. The wire passed through a horizontal opening in the matrix body. Dimensioning devices for determining the extent of the movement of the blade were adopted, a wedge being employed for this purpose. Justifying increments were added to the spaces only. A new feature was introduced whereby a line of inaccurate length caused a stoppage of the entire machine. The machine itself was pneumatically actuated. This, the sixth machine, improved by J. Sellers Bancroft, of which more than 100 were sold, became the basis of the present machine. Early in 1898, Tolbert Lanston discontinued his connection with the manufacturing department and assumed an advisory relationship with the company. He died on February 18, 1913 in Washington, D. C.

The users soon discovered that the chief fault in this machine of 1897 was the limitation of the matrix font of 132 characters. In 1899, J. Sellers Bancroft met this objection by building a full font machine, using 225 characters. In its general construction, was much the same as the machine now in use, although many

important improvements have since been made. The most important advance in the 1899 machine was the die case positioning mechanism. In the earlier machine, there were many useless movements, as the die case and cooperating elements were restored to zero position after each operation. J. Sellers Bancroft succeeded in making every movement effective, nearly doubling the rate of production, while insuring greater accuracy.

LANSTON and DOVE were fortunate in securing, in the earlier stages of the invention, the assistance of Harold Malcom Duncan, who had a more intimate knowledge of type-composing machines and typography than either of them, and thus was of invaluable assistance in creating the Monotype system of type composition. The name of Linn Boyd Benton must also be associated with the success of the Monotype Machine. His invention of the punch-cutting machine was as vital to the Monotype Machine as it was to other typesetting machines. Without Bentons brilliant invention all these machines were impracticable, because the rapid and economical production of punches and matrices was the prime need of each of them. In 1896, Duncan was appointed General Selling Agent within the United States, and, as mentioned in an earlier paragraph, about 100 limited-font machines were sold. At this time the need of factory equipment was urgent, and funds were required to purchase it. It was decided to sell the patent rights for Great Britain and its dependencies, except Canada. Dove and Duncan took a limited-font machine to London in July, 1897 where it was demonstrated to such good effect that the sale was negotiated for the consideration of $1,000,000.00, part cash and part stock, to a syndicate of capitalists of high position, including a few leading publishers and printers who sub-

sequently formed The Monotype Corporation, Ltd. by sales of stock to the investing public. A factory was erected in which to manufacture the machine and matrices. Duncan remained for a while as technical advisor to the English company. Dove returned to America and developed the present, efficient manufacturing organization. Thus, the Lanston Monotype Machine Company started in its own plant on a highly successful career

DUNCAN, having established the English factory returned to the United States to assist Dove. However, he was recalled and not long afterwards, was appointed Managing Director of The Monotype Corporation, Ltd. The Lanston Monotype Machine Company and The Monotype Corporation, Ltd. are quite independent of each other, though interchanging ideas and improvements in a most friendly spirit.

In applying the Monotype Typesetting Machine to produce a miscellaneous variety of typographic composition over a period covering more than 50 years, many attachments and adaptions have been applied which have not necessitated important structural alterations in the typecasting mechanism. This fact, in itself, is important testimony to the far-reaching scope and perfection of Lanston's invention.

The first major improvement was the development of a new keyboard, with a universal typewriter-key arrangement and air-cushion touch. Later, the range of the keyboard was increased from 65 to 90-ems. The cellular matrix took the place of the original side-hole matrix. The casting and delivery of full kerning characters was provided for. Multiple justification of several columns of words and figures within a single justified line was worked

out. New molds, and methods of water-cooling them were applied. The "low" quad mold and the use of Monotype quads as base for mounting electrotypes and halftones were early developments. Means for automatically providing for "close" "normal", and "wide" word spacing were perfected. Electricity was applied to the melting pots. The automatic "repeater" was applied to the keyboard which permits quads, dashes, leaders, etc. to be keyboarded at the rate of 36,000 ems per hour. The capacity of the casting machine was extended to compose justified lines up to and including 60-picas in length. The development of the Automatic Quadding & Centering Attachment provides a simple means for quadding out lines, for centering words on any measure, combining folios and headings, and facilitating the composition of leader work. It relieves the operator of the necessity of knowing or estimating the length of words to be centered at the Keyboard, and relieves the strain on finger muscles caused by individual quadding.

As a result of approximately seven years' field testing of pilot models of the 1517 Casting Machine the Monotype Company started in 1946 to accept orders for the commercial models. The advantages of the extended matrix case which provides 30 additional characters, was quickly recognized. By 1952, the purchase of 1517 Casting Machines so heavily outnumbered the demand for 1515 Casting Machines that the Monotype Company decided to discontinue manufacture of the 1515 Casting Machines. Through this major improvement, the number of positions in the matrix case were increased from 225 to 255; and a quick, simple adjustment provides the means of easily changing the casting machine operation to accommodate either style of matrix case.

The 30 additional matrices reduce the number of matrix changes within the matrix case, and fewer changes of one matrix case for another; thus, materially increasing the ratio of production on the casting machine. Fewer galley changes are needed because on each job there are more type characters combined in one matrix case.

The standard Keyboard is used to perforate the Controller Paper. 17 Justifying Keys are used instead of 30 Justifying Keys, and are located about 4 inches closer to the operator, which makes one-hand justification a practical operating procedure. Keybanks and Keybars are available so that the full capacity of the extended matrix case can be utilized. 7-alphabet arrangements are provided which make possible one handling of the copy instead of two and the increased number of available characters makes fewer cappings of the Keybuttons necessary. The touch arrangement of both Light Italic and Bold Roman keys on the right Keybank (instead of splitting Italic keys over both left and right Keybanks) does not break the operator's rhythm when setting mixed copy.

SUBSTANTIAL SAVINGS are made in hand work required to insert special characters in many classes of composition; and, the ability to carry Roman, Bold Face Italics, and small caps in one 7-alphabet case eliminates much hand work necessary before the introduction of the 1517 Equipment. The advantages inherent in this equipment have been increased by the development of the Patton Spacing Attachment.

THE PATTON SPACING ATTACHMENT represents a new and important forward step in the development program of Monotype.

When a justifying key is struck, together with an upper, lower, or double 15 Key, the pump is locked and justification takes place in the ordinary way. When a justifying key is struck alone, the combination of J and H signals is punched. These J and H signals lock the top mold blade over the mold opening, while the fixed low space of the key's corresponding unit value in the matrix case is cast. With this attachment all spaces are cast in the H row of the matrix case. This improvement places at the disposal of the keyboard operator fixed low spaces for every unit row in the Stopbar. All steel blank matrices can be replaced by "live" matrices in the matrix case. This improvement provides production advantages while, at the same time, reduces the burden on the operator. Suppose 13 units were needed to "get on the em or on the wheel." Using the conventional method would require the keyboard operator to strike 9-6-6-5-5 (the number of spaces and unit values required). With the Patton Spacing Attachment, which would cast a 13-unit low space from the matrix occupying the 13-H position in the matrix case, the keyboard operator eliminates 4 key strokes and an equal number of caster revolutions are saved. This simple illustration dealing with "getting on em" or "getting on wheel" at paragraph ends in straight matter is important but the Patton Spacing Attachment is even more valuable in tabular, tariff, catalog, and similar composition. On the Casting Machine, the operator is relieved of the necessity of making critical adjustments because a great number of the parts previously employed are eliminated; the elimination of the steel blank matrices in the matrix case reduces considerable wear on the matrix seat of the mold, and, the reduction in casting required spaces provides added production of composition.

With the development of photo-mechanical typesetting, it is significant that the proven basic mechanical principles embodied in the Monotype hot metal typesetting machine are incorporated in "Monophoto", a trade name given to the photo-typesetting machine resulting from the development program of The Monotype Corporation, Ltd., London, England.

It will probably surprise many to learn that patent records of photo-type-composing inventions extend back over 75 years. More than 120 patents are evidence of the variety of solutions developed. Only in recent years have photographic-type-composing machines become a practical reality. Probably no other development in the Graphic Arts Industry since the end of World War II has attracted as much interest as has photographic typesetting. One such machine has already been introduced to the commercial market.

The Monotype Corporation in England recognized this trend over twenty years ago and embarked on a development program to design a practical and dependable photo-type-composing machine for the Graphic Arts Industry. They set as their objective a machine that would fully utilize the skill of existing operators and associated personnel by providing mechanisms and procedures with which they were thoroughly familiar.

"MONOPHOTO" incorporates the proven basic mechanical principles embodied in the Monotype hot metal typesetting machine that has been in wide use in commercial, book, and magazine fields for fifty years.

As in the Monotype hot-metal typesetting machine, the manual operation of transcribing the copy is divorced from the automatic

mechanical photographic operation. The photographic unit is controlled by the perforated controller paper ribbon produced on the Keyboard unit. Thus, optimum production can always be realized from both of these separate and entirely different operations that are present in all successful mechanical typesetting machines.

The standard Monotype Keyboard now in use in plants all over the world is used for perforating the paper controller ribbon. Keyboard procedure is the same whether the controller ribbon is used on the hot metal Monotype machine or the "Monophoto" machine. Any competent Monotype Keyboard Operator can perforate the "Monophoto" ribbon without any re-training because there is no change in his procedures.

The same set-sizing and justifying principle is used in "Monophoto" that has made the Monotype Typesetting Machine the most preferred method for producing tabular composition and the only typesetting machine that can economically produce quality straight typesetting superior to the finest hand set composition composed by the most skilled hand compositor.

Therefore, "Monophoto" is built on fundamentally sound and proven principles.

The "Monophoto" machine is actuated by the perforated paper ribbon prepared on the Monotype Keyboard that controls the mechanism that locates the wedges and the photo-matrix-case so that the required character will be in correct position for photography. Where the Monotype hot metal Composition Caster uses a centering pin to locate the individual matrix for casting, the "Monophoto" Machine obtains the equivalent position by use of racks along the margins of the photo-matrix case. The photo-

graphic system consists of a projection light assembly; a mask to limit the illuminated area; the photo-matrix case; a line shutter to block the light between line movements, or when the line-killer is used; the character shutter that opens for the exposure of each character; a self-contained optical system of lens and two prisms that enlarge or reduce the image to any point size or intermediate size within its range (normally 6 to 24 pt.); a scanning device consisting of two first-surface mirrors that are controlled by the wedges and move in proportion to the set width of each character to project each character image successively along the line of composition; and the film magazine that holds the sheet or galley length of film in position for photography, advancing it by the desired body size for each successive line of composition.

The normal operational procedure is to place the perforated paper ribbon in position on the paper tower; insert the photo-matrix case and the proper wedge corresponding to the keyboarding; set the optical system to the required point size of reproduction; rotate the dial on the film magazine to the desired body size; insert the film magazine and open its exposure gap. The light is then switched on and the machine put in operation. Upon completion of the run, the machine stops automatically, the operator closes the exposure gap in the film magazine, removes it from the machine and turns it over to the Camera or Darkroom Operator for processing and proceeds with the next job.

Any commercial photo-mechanical film or sensitized paper can be used on the "Monophoto" machine. This includes thin or thick base film, strip film, or bromide paper of the desired size selected to fit the cut, page, or galley length desired and in any

width up to eleven inches for 60 pica em composition. The sensitized material is loaded in the drum or magazine in the darkroom in the size and type of emulsion required.

The photo-matrix case layout can correspond with any standard or special layout used on the hot metal Monotype Composition Caster. The characters are similarly arranged in unit rows and are approximately 8 pt. in size. While the "Monophoto" machine is capable of reducing or enlarging these 8 pt. characters between the range of 6 and 24 pt., typographical design considerations may necessitate the availability of several matrix negative masters each representing a range of point sizes to minimize the character distortion that would result, if, for example, an 8 pt. design is used to produce 18 pt. composition. The choice of the number of photo-matrix masters to be used for a particular type face is determined by the user and will be governed by the nature of his work and degree to which character design distortion can be tolerated.

All of the versatility of the Monotype System—the composition by individual characters the unit system of values facilities for automatic centering and quadding, the line-killer for keyboard errors, and the wide measure—are retained in the "Monophoto" machine. The "Monophoto" product is also prime photography, as are the corrections that are inserted into the original composition, with the consequence that top character definition and quality are retained without the loss of detail.

"MONOPHOTO" will find useful application to many branches of the graphic arts industry and while photo-type composition may currently have limitations in some specific fields, its potentialities

in others will gradually expand its usefulness. Since the characters are freed from the mechanical limitations of type metal, severe kerning will simplify the type designer's problems.

Interesting possibilities are suggested by multiple exposures to combine common character elements such as have been employed in setting oriental languages or for scientific formulae composition where the normal capacity of the matrix case is ordinarily wholly inadequate.

Some of the advantages of "Monophoto" are:

High quality of the composition that results from prime photography and structural rigidity of the "Monophoto" machine, as the entire optical system is immobilized during the interval of exposure.

Ability to produce any fractional point size composition within the range of 6 to 24 point.

Ability to compose any width or measure on any photographic film or paper up to 60 pica-ems width of composition.

Ability to determine body size after completion of the keyboarding so that required leading can automatically be included.

Separation of keyboarding from the photo-composition permitting the "Monophoto" to operate continuously, irrespective of keyboard stoppages, and to accept the product of several keyboards.

Production speed of over 200 characters per minute regardless of point size of the composition.

Availability of Monotype Library of type faces and typographical "know-how."

Capacity of the photo-matrix case; the simplicity of interchange of cases, and the ability to use a single character an unlimited number of times in each line.

Flexibility that permits Roman, Small Caps, Italic, and Boldface to be mixed at will, in the same line or throughout the copy, without machine change or adjustment in sizes from 6 point through 24 point.

If film positive is damaged, keyboarding does not have to be repeated, as the paper ribbon can be used again.

Utilization of existing Keyboards, existing personnel, experience, and methods so as to easily bridge the transition from hot to cold composition.

"MONOPHOTO" is here today as a working reality. Although, relatively in its infancy it will grow in usefulness and scope until it will be accepted as a standard and indispensable facility in the reproduction of quality typography.

TOLBERT LANSTON thought of the Monotype merely as a mechanical means of setting type, having no conception that the ideas

and principles embodied in his type caster would be developed, first, to cast type up to 36-point and later to 72-point; and, that his invention would become the basis of an entirely new and revolutionary system of composing-room operation called "Non-Distribution" through which the drudgery and cost of distributing type and all material up to 72-point were eliminated.

While the modern strip-casting machine did not grow directly out of the typecasting machine originated by Lanston, it is probably accurate to say that if the Monotype had not been invented, Lester Walden, the Monotype casterman who invented the method of welding which is the basis of such machines, would have had neither the opportunity nor the incentive to carry on the work which, after many trials, finally resulted in perfecting the Lead & Rule Mold. With the development of the Lead & Rule Mold, Monotype Non-Distribution was extended to borders, rules, leads and slugs. The later development of the Monotype Material Making Machine further increased the speed of casting strip material. When the Monotype Giant Caster was first marketed in 1926, complete Non-Distribution up to 72-point became a practical composing room procedure.

Through the more than 60 years since Tolbert Lanston was granted his first patent, the names of many men rightfully belong on the Honor Roll of those who in their divers ways contributed continuing improvements to The Monotype System. However, the names of Lanston, Dove, Bancroft, and Duncan stand out because through their courage, skill, determination, and imagination, Monotype matured into a practical contribution to the Arts, Sciences, and Industry; and, today meets current needs as ably as those early machines met the needs of their day.

This Booklet made possible through the cooperation of:

MR. FERDY J. TAGLE. Principal
The New York School of Printing

MR. JOSEPH QUIGLEY, Sales Manager
Lanston Monotype Machine Company

MR. ROCCO GIORGIO, District Mgr., N. E. District
Lanston Monotype Machine Company

MR. PETER LISANTI, Instructor
The School for Printers' Apprentices

Printed in the School